Updated: July 23, 2014

USCG Research & Development Center

Arctic Technology Evaluation 2014:
August 8 - 30, 2014

INSIDE FEATURES:

Arctic Technology Evaluation Newsletter Author and Public Affairs Officer:

LT Keely Higbie
Keely.J.Higbie@uscg.mil
860-271-2815

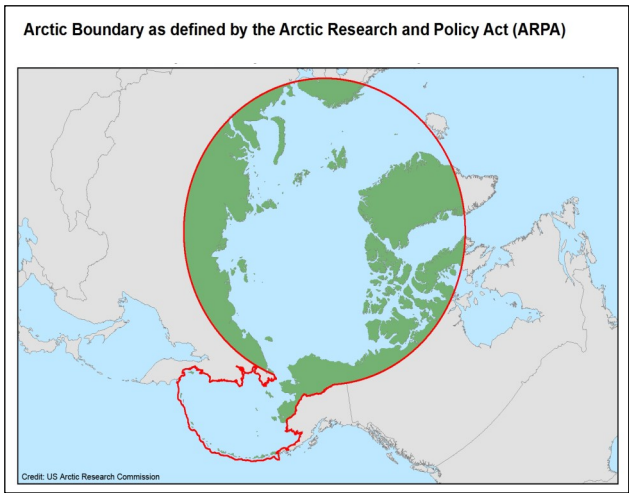
The Research & Development Center (RDC) is bringing a team of 52 scientists onboard the Coast Guard's premier research vessel, USCGC HEALY, from August 8th through 30th for a technology evaluation to improve Coast Guard capabilities in the Arctic. The team will embark the ship in Seward, Alaska and transit north into the ice.

Four RDC projects will be the focus of this year's exercise: Arctic Craft Improvements, Arctic Communications Testing, Arctic Navigation Improvements, and Oil in Ice Interaction projects.

Arctic Craft Improvements. The presence of ice in water and the lack of shore infrastructure in the Arctic have made boat operations increasingly difficult off the North Slope of Alaska. The RDC has been investigating ways to improve boat operations over the past several years. In 2012, the RDC published a Broad Agency Announcement that requested offerors to demonstrate their craft with advanced Arctic capabilities in the North Slope. These demonstrations showed that although these craft had impressive capabilities, they were not well suited for conducting Coast Guard missions in the Arctic. The decision was then made to move forward with this year's project of making modifications to existing Coast Guard boats to improve their performance in the harsh environment.

Communications. Reliable communications are becoming increasingly important in the Arctic region as activity increases. The vast distances, lack of communications infrastructure, harsh weather conditions, and high latitude ionic disturbances combine to make communications in the Arctic difficult. The need for reliable communications is required for positive tactical control of operational units and for emergency communications with mariners operating in the area. To help improve communications in the Arctic, this project will assess High Frequency (HF), Very-High Frequency (VHF), Ultra-High Frequency (UHF) and satellite communications signal strength to evaluate system coverage and improve signal modeling.

USCGC HEALY



The Arctic Region

Navigation. There is a lack of reliable navigation safety information to help mariners identify, assess, and mitigate navigational risks the in Arctic region. The Coast Guard currently does not own any of its own electronic Maritime Safety Information (eMSI) infrastructure in Alaska. Thus, for this project, the Coast Guard is partnering with the Marine Exchange of Alaska (MXAK) to leverage MXAK's extensive Automatic Identification System (AIS) infrastructure to demonstrate the delivery of critical eMSI information to local mariners and ultimately improve navigational safety.

Oil in Ice. The RDC has done extensive work on oil recovery in icy waters and on top of ice, but little is known regarding the movement of oil at the ice edge. This year, to observe the horizontal and vertical movement of simulated oil at the ice edge, the RDC will deploy multiple unmanned technologies to stream imagery and video feeds of the simulated oil movements over a 48-hour period. Due to the extreme cold temperatures in the Arctic, unmanned technologies are excellent situational awareness tools and also have great potential to aid the Coast Guard in performing its missions in this area. In 2013, the RDC brought several unmanned technologies onboard USCGC HEALY and evaluated their performance in the cold weather environment. Based on lessons learned last year, the RDC will deploy new or improved technologies, evaluate their performance in the Arctic environment, and assess their utility to enhance Coast Guard capabilities.

In addition to the RDC's own tests and evaluations, the project staff will provide support to partner organizations and agencies who are joining this year's patrol in accomplishing their own Arctic objectives.

Meet The Science Team

The 52-member science team is made up of multiple agencies and organizations including:

- **U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL)**, who is assisting with the Arctic Craft Improvements assessment and Oil In Ice exercise
- **NORTHCOM,** who works closely with Lockheed Martin on military communications
- **Lockheed Martin,** who developed, manufactured, and launched the Mobile User Objective System (MUOS) satellite which is being assessed in the Arctic Communications project
- **MXAK,** who is providing eMSI infrastructure for the Arctic Navigation project
- **National Oceanic & Atmospheric Administration (NOAA)**, who is flying Puma unmanned aircraft systems (UASs) and inputting exercise data into their Environmental Response Management Application (ERMA) for the Oil In Ice exercise
- **Space and Naval Warfare Systems Command (SPAWAR)**, who is providing the Wave Glider SV unmanned surface vessel (USV) for the Oil In Ice exercise
- **Inland Gulf Maritime (IGM)**, who is providing the aerostat for the Oil In Ice exercise
- **National Ice Center (NIC)**, who is observing ice conditions and assisting with the Ice Radar for the Oil In Ice exercise
- **University of Cambridge (UK),** who is providing the Gavia autonomous underwater vehicle for the Oil In Ice exercise
- **University of Washington Applied Physics Lab**, who is providing their SWIFT meteorological buoys for the Oil In Ice exercise
- **National Science Foundation (NSF)**, who is providing technical and logistical support for the evaluation
- **DHS HS-STEM Program,** who is providing an intern to shadow the project manager and assist with the evaluation

The following Coast Guard units/ program offices are also part of the science team:

- **Regional Dive Locker San Diego**, who is assisting with the remote operated vehicle (ROV) assessment as part of the Oil In Ice exercise
- **USCG Academy,** who is providing two ROVs for the Oil In Ice exercise
- **Office of Telecommunications Strategic Plan & Policy (CG-6521)**, who is assisting with the Arctic Communications assessment
- **USCG District 17,** who is coordinating the RDC's efforts with Arctic Shield 2014

Working with these agencies and organizations embraces the Coast Guard's strategic objective of "Broadening Partnerships" in accordance with the Arctic Strategy. The Coast Guard and each of these agencies and organizations have collective goals and interests in the Arctic region, and by working together, we can collectively build our knowledge, capacity, and resilience.

"Our participation in Arctic Shield 2014 is designed to expand District 17's and the various Coast Guard Program office's capabilities by identifying new technology which will allow the Coast Guard to better perform it's missions in the Arctic."

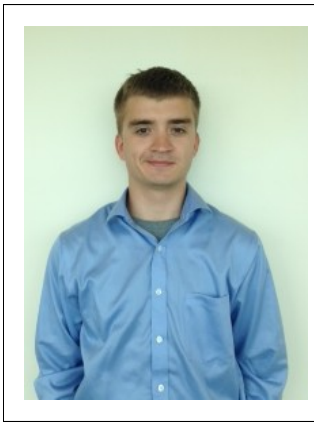
- Rich Hansen, Chief Scientist

Academic Partners: DHS HS-STEM Program

Article by DHS STEM Intern, Anton Yanchilin

I have been selected to work at the RDC as an intern for 10 weeks through the Department of Homeland Security (DHS) Homeland Security related Science, Technology, Engineering, and Mathematics (HS-STEM) summer internship program. The goal of this program is to complement the studies of students who are pursuing STEM career paths with a menu of experiences throughout the different components of the Department of Homeland Security. Students submit a single application and select projects they are interested in, and DHS selects and refers students to the hosting facility. Currently I attend Creighton University and will be using my Applied Physical Analysis and Energy Technology studies and experience to be an active planner and participant in the Arctic Shield 2014 Technology Evaluation aboard the Coast Guard icebreaker and research vessel, CGC HEALY.

I aspire to become a research scientist after graduate school, specifically in the field of renewable energy. I look forward to working with the unmanned technologies during this summer's deployment, especially those that are self-sustaining such as the Wave-Glider USV. This is a very unique opportunity for me to experience their test and evaluation first-hand in the Arctic Circle and also see what a job in government research entails. Participating in Arctic Shield 2014 with the RDC and their partner agencies/ organizations, I will expand on what I learned in school through dynamic involvement as well as make decisions about my professional future.



DHS HS-STEM Program Intern, Anton Yanchilin

Arctic Craft Investigation

RDC Lead: Jason Story, Surface Branch

The ARKTOS Evacuation Craft

The RDC has been investigating ways to improve boat operations in the Arctic since 2012. Naval Architect, Marine Engineer, and Project Manager Jason Story worked with representatives at the Office of Boat Forces (CG-731) and D17 to develop a list of capabilities thought to improve the function of a craft operating in the Arctic. The RDC published a Broad Agency Announcement (BAA) and requested offerors to provide a craft with these advanced Arctic capabilities for five days of demonstration in Barrow, Alaska.

The RDC selected the two best responses to the BAA for the demonstration. The first was the ARKTOS Evacuation Craft which was developed for the offshore energy companies that required a lifeboat that could operate from their installations in ice covered seas. The craft consists of a permanently linked pair of laminated composite hybrid hulls. It has a track system for motive power on land and water jets for propulsion in the water and is 50' in length. The other craft was the Tyler Rental Inc's Alaska Amphibian MK-IV which is a 26'-long aluminum mono-hull vessel with retractable tracks.

Coast Guard personnel observed and analyzed all aspects of their operations including craft performance, craft reliability, craft storage, transportation concerns, and other logistical issues during the five day demonstration. At the end of this phase, project sponsors, stakeholders, and the RDC determined that the craft currently available on the market are not capable of effectively executing all Coast Guard missions in the Arctic. "Until a technology is identified or developed that can meet more of the Coast Guard's boat capability requirements, the Coast Guard will have to rely on existing craft for Arctic boat operations," said Story.

Tyler Rental Inc's Alaska Amphibian MK-IV

Last year, the RDC assessed the effects of brash ice (fragments of ice less than two meters in diameter) on boat propulsion. This collaborative testing took place at the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, New Hampshire.

This year, the RDC is continuing the Arctic Craft project and is investigating improvements to existing Coast Guard boats to make them better suited for operations in the harsh Arctic environment based on further input from CG-731, Surface Forces Logistics Command (SFLC), and D17. For this project, the RDC is outfitting USCGC HEALY's Arctic Survey Boat (ASB) with various equipment upgrades to improve cold weather capabilities. Defoggers will be installed to address fog build-up that results when a warm cabin windows are shared with the cold Arctic air. The boat is also being equipped with multiple coolant, fluid, and battery heaters to improve engine performance. In addition to these cold weather performance improvements, multiple imaging systems will also be installed onboard the ASB. These include a 3-D underwater imager, forward looking sonar, an underwater camera, an infrared camera, and streaming video equipment.

The objective of this project is to evaluate each piece of equipment individually to assess its effectiveness in severe cold weather, record its power usage and heat output (if applicable) to ensure the boat's electrical systems are not overwhelmed, and gather information on possible improvements of Coast Guard boat operations in the Arctic. This will enable to RDC to make recommendations to improve Arctic boat capabilities and configurations.

CGCGC HEALY's ASB

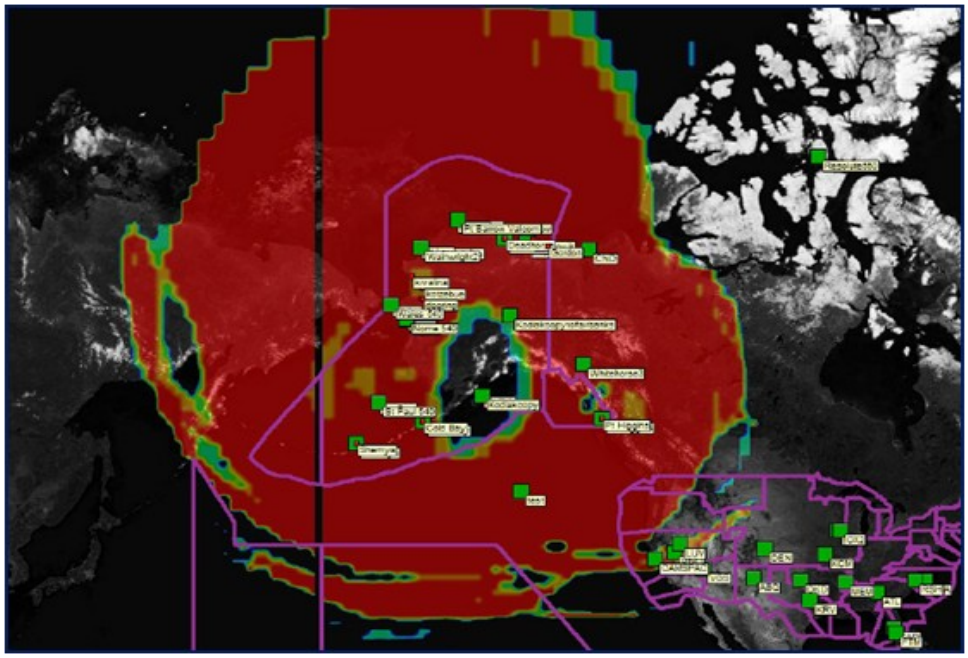
"Until a technology is identified or developed that can meet more of the Coast Guard's boat capability requirements, the Coast Guard will have to rely on existing craft for Arctic boat operations."

Jason Story, Arctic Craft Project Manager

Arctic Communications

RDC Lead: Liz Weaver, C4ISR Branch

The Arctic Communications project includes both communications model verification and MUOS satellite coverage assessment at high latitudes.



Modeled Communications Coverage for August 2014

Model Verification. The RDC and DHS Science & Technology (S&T) Directorate Borders and Maritime Security Division (BMD) are evaluating existing and future communications systems to support the Coast Guard's expanding need to communicate voice, data, and video from the Arctic. During this summer's exercise, the RDC will conduct signal strength testing of High Frequency (HF), Very-High Frequency (VHF), and Ultra -High Frequency (UHF) communications circuits in Alaska to evaluate system coverage and improve signal modeling.

"The data captured will be used to assess communication system performance predictions..."

Liz Weaver, Arctic Communications Project Manager

To collect this data, members of the RDC will collect signal strength information, space weather information, and environmental data at regular intervals during each day of deployment. Testing will cover all periods of the diurnal ionospheric cycle. A Global Positioning System (GPS) will provide ground truth for vessel position.

Once the data is collected, analysts will compare signal strength predictions with known ship and transmitter positions to improve model parameters. "The data captured will be used to assess communication system performance predictions and, if needed, also be used to modify future modeling efforts," said Project Manager Liz Weaver. As such, this project falls in line with the Coast Guard's Arctic Strategy objective of "Improving Awareness" in the Arctic region.

MUOS Coverage. In addition to model verification, the RDC is also collaborating with NORTHCOM to obtain assistance from Lockheed Martin to assess MUOS satellite coverage in high latitudes onboard USCGC HEALY.

MUOS was developed, manufactured and launched by Lockheed Martin. It is a next-generation narrowband tactical satellite communications system designed to significantly improve communications capability over existing systems, including simultaneous voice, video and data - similar to the capabilities experienced today with smart phones.

Since USCGC HEALY is not equipped with gear to receive MUOS, Lockheed Martin will be providing their own radios that are designed to communicate with MUOS to demonstrate group voice "reach back" capability and measure/characterize MUOS performance in high latitudes.

Lockheed Martin recently launched a new MUOS satellite to cover higher latitude regions. It has significant potential to improve communications coverage in the Arctic region, and this testing will help the Coast Guard and its partners better understand MUOS's extents and capabilities.

For more info on the MUOS Satellite, visit developer Lockheed Martin's website at http://www.lockheedmartin.com/us/products/mobile-user-objective-system--muos-.html.

Next Generation Arctic Navigation

RDC Lead: LCDR Mike Turner, E&W Branch

The RDC has partnered with the Marine Exchange of Alaska (MXAK) to address the lack of reliable navigation safety information to help the mariner identify, assess, and mitigate navigational risks in the Arctic region.

MXAK was established in 2000 to bring the Alaska maritime community together with the common goal of providing information, communications and services that aid safe, secure, efficient and environmentally responsible maritime operations. MXAK has developed an extensive electronic Maritime Safety Information (eMSI) vessel tracking system in Alaska with over 95 AIS receiving to aid safe, secure, efficient and environmentally sound maritime operations.

For more info on MXAK's activities, visit their website at http://www.mxak.org/

The Coast Guard currently does not own any of its own eMSI infrastructure in the Arctic. "By partnering with MXAK, the Coast Guard can leverage MXAK's extensive Automatic Identification System (AIS) infrastructure to demonstrate the delivery of critical eMSI information to local mariners," said Project Manager LCDR Mike Turner.

Examples of the types of navigational safety information that the Coast Guard is interested in transmitting to mariners includes weather, ice, and safety zone information to name a few.

The Cooperative Research and Development Agreement (CRADA) that the Coast Guard has with MXAK will last for a (extendable) period of three years. During that time, the Coast Guard hopes to expand its navigational safety information transmission capabilities from near-shore, which is being tested during this summer's deployment, to beyond line of sight over the duration of the CRADA.

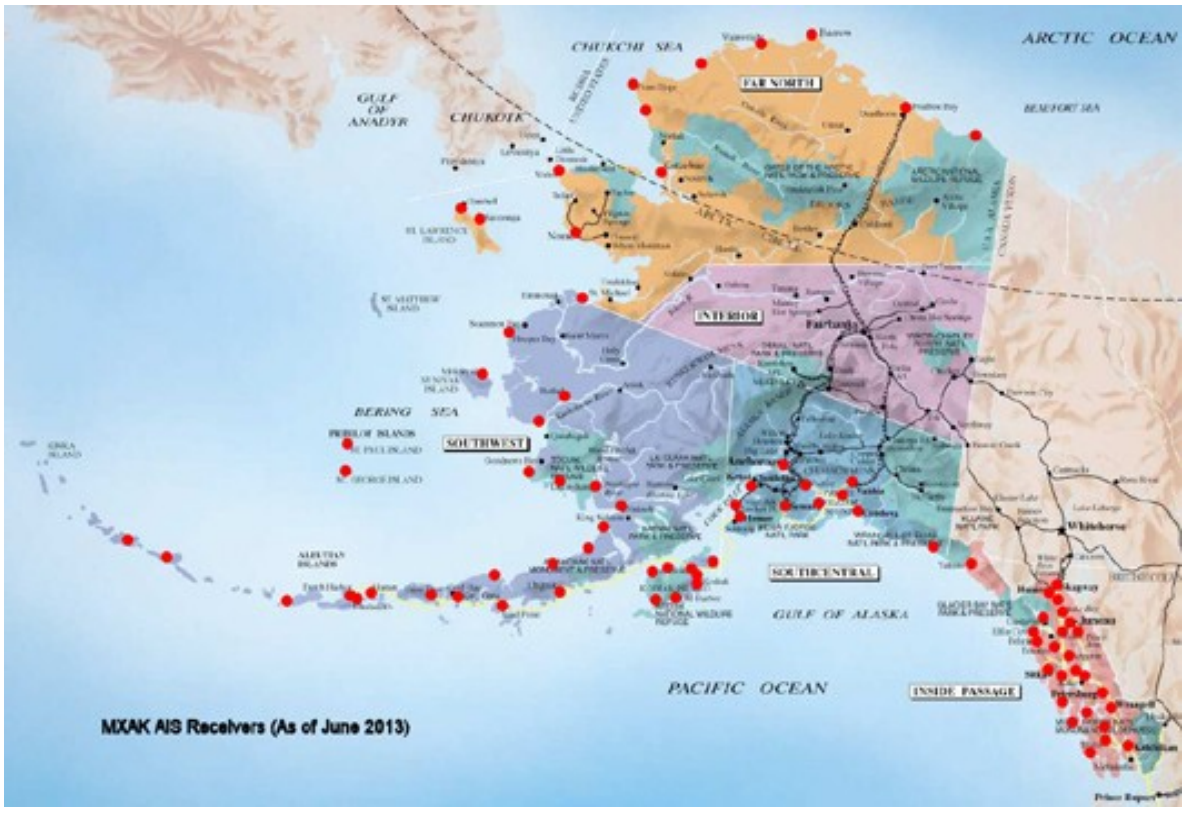
The RDC & AIS

Article by Scott Fields

The RDC is actively involved in supporting NAIS efforts and advancing Coast Guard's capability to receive, transmit, monitor, and ensure integrity of data throughout the NAIS network. Current efforts of the RDC in AIS include: Supporting NAIS in receiver performance monitoring, international and national AIS standards development, investigating long range reception solutions, transmitting AIS messages in the Arctic in conjunction with Marine Exchange Alaska, intergovernmental (USCG and US Army Corps) joint AIS demonstration around Louisville on the Ohio River to confluence of the Mississippi River.

"By partnering with MXAK, the Coast Guard can leverage MXAK's extensive AIS infrastructure to demonstrate the delivery of critical eMSI information to local mariners."

LCDR Mike Turner, Arctic Navigation Project Manager



Marine Exchange of Alaska (MXAK) AIS Receiver Sites

Oil In Ice Interaction

RDC Lead: Kurt Hansen, E&W Branch

The RDC's Oil In Ice project has been increasingly more active over the last five years. Much of the work to date has been completed in the Great Lakes, which like the Arctic, experiences icing conditions.

This year, since little is known regarding the movement of oil at the ice edge, the RDC will deploy multiple unmanned technologies to observe the horizontal and vertical movement of simulated oil at the ice edge over a 48-hour period. Due to the extreme cold temperatures in the Arctic, unmanned technologies are excellent situational awareness and extended surveillance tools for this exercise. Team members will evaluate each piece of equipment and its sensor capabilities to assess its effectiveness in tracking the simulants.

The data collected during this exercise can provide information about tracking oil simulants near the ice edge and interactions with the ice edge. The RDC will deploy two oil simulants, fluorosence dye and fresh oranges. Last year, the RDC deployed peat moss and frozen oranges. These environmentally safe materials behave similar to oil when in the water, however the oranges shrank and became dark in color, which made them difficult to see. Using these other simulants should improve technology sensor performance.

"This exercise is critical to improving the Coast Guard's understanding of how oil interacts with ice and will ultimately help decision makers understand how best to track and recover oil near the ice edge," said Project Manager Kurt Hansen.

Oil In Ice Technology Demonstration 2012

"This exercise is critical to improving the Coast Guard's understanding of how oil interacts with ice and will ultimately help decision makers understand how best to track and recover oil near the ice edge."

Kurt Hansen
Oil In Ice Project Manager

Environmental Response Management Application (ERMA)

The RDC is partnering with NOAA to integrate shipboard and unmanned technology data into ERMA. ERMA is an online mapping tool that integrates both static and real-time data such as ship locations, weather, ocean currents, and imagery into a centralized, user-friendly Geographic Information System (GIS) format for environmental responders and decision makers.

Last year, NOAA provided similar support for the RDC's Oil In Ice Technology Demonstration, and ERMA proved to be an extremely useful situational awareness tool. This year, based on lessons learned, the team hopes to integrate data at closer to a real-time pace and sync to shore to further demonstrate the application's utility to enhance Coast Guard oil spill response operations.

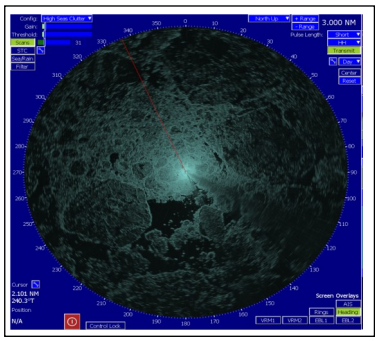
For more info on ERMA, visit http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma

Ice Radar

The Coast Guard relies on radar to fulfill multiple vital missions. In the Arctic, this sensor becomes crucial in times of limited visibility, especially when a vessel is transiting in ice-covered waters. Ice radars have the capability to help crews identify different types of ice, as well as its thickness.

For this year's exercise, the RDC will outfit USCGC HEALY with a Rutter Radar's Ice Navigator processor. The key to this processor is that it processes a full dynamic range of data (12-bit video) versus the 2-4 bit intensity in standard navigation radar that are more than adequate to identify other vessels, buoys and points of land. This processor then is able to produce a higher-quality image for better ice definition.

For more info on Rutter Radar's Ice Navigator Processor, visit http://www.telemaruk.com/



Rutter Radar Display with Ice Navigator

Unmanned Technologies

The Coast Guard sees great value in the implementation of unmanned technologies in the harsh Arctic environment. "By utilizing unmanned technologies to aid the execution of our missions and duties, the Coast Guard can expand its reach with reduced resources and less risk to personnel in the severe cold," said Lt. Keely Higbie, this year's RDC Arctic UAS Lead.

For that reason, multiple unmanned technologies are being explored during this summer's deployment as diver replacement tools and aerial, surface, and sub-surface situational awareness tools. These include an Aerostat, two unmanned aircraft systems, autonomous underwater vehicles, and multiple remote operated vehicles.

Aerostat

RDC Lead: Mike Coleman, Surface Branch

IGM/Qualitech Environmental Aerostat System

The RDC and the Oil Spill Response Institute are deploying Inland Gulf Maritime (IGM)/QualiTech Environmental Aerostat System to support the Oil In Ice Interaction project. This system is a self-contained, compact Aerostat platform that can deploy multiple sensor payloads up to a total of 40 lbs in weight to an altitude of 500 feet. As currently configured, it uses a winch-controlled launch and recovery system and has a main tether line that anchors the Aerostat to the main base and transfers electrical power to the sensors, which eliminates the need for heavy batteries.

The payload package being utilized for this exercise includes the following sensor capabilities:

- Electro-optical/infra-red (EO/IR) camera with automatic tracking and geo-tagging capability
- Continuous real-time aerial video feed through wave relay technology

The aerostat system will provide a common operating picture for emergency spill response by providing aerial surveillance and high speed data connectivity for a 48-hour period.

For more info on IGM's Aerostat System, visit IGM's website at http://www.inland-gulf.com/

"By utilizing unmanned technologies… the Coast Guard can expand its reach with reduced resources and less risk to personnel in the severe cold."

LT Keely Higbie
RDC Arctic UAS Lead

Autonomous Underwater Vehicle (AUV)

RDC Lead: Scot Tripp, Surface Branch

AUV's Utility

AUVs have a lot of utility in enhancing Coast Guard operations. In addition to providing underwater imagery, certain sensor packages can also be used for plume mapping and tracking. This sensor maps out the size of a spill, which gives responders a more accurate picture of how much oil needs to be recovered and the direction in which it is drifting.

Based on the results of last year's exercise, it was apparent that AUVs are useful diver replacement tools, especially in cold, Arctic waters. With a much longer endurance, AUVs could be used for resource exploitation monitoring and for patrolling living marine resource zones by acoustically detecting when fishing vessels enter restricted waters.

For more info on Gavia Scientific AUV, visit the manufacture's website at http://www.teledynegavia.com.

For this exercise, the RDC and University of Cambridge will deploy the Gavia Scientific AUV to map under ice ridges to better understand the typical topography of ice floes as well as provide underwater imagery of the movement of oil simulants in the water over an extended period of time.

The Gavia Scientific AUV is a self-contained, man-portable, modular survey platform that is approximately 6 feet in length, weighs 108 pounds , and can travel at a speed of greater than 5.5 kts.

The Gavia Scientific AUV can operate underwater for 7 hours or more depending on the speed and payload configuration. Typical configurations include:

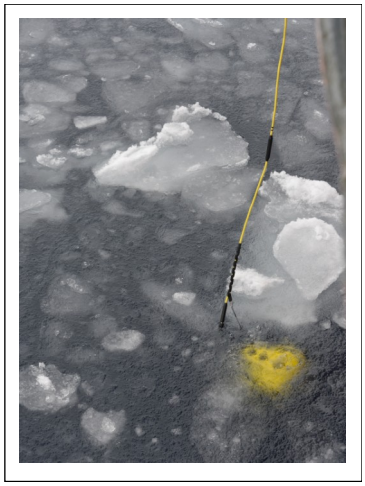
- High-precision Doppler Velocity Log (DVL) aided Inertial Navigation System (INS)
- Side scan sonar
- Sound velocity meter
- Obstacle avoidance radar

Gavia Scientific AUV

Deploying this technology will help the Coast Guard better understand how oil moves and interacts with the ice, and will enable the Coast Guard to determine the best recovery method.

Remote Operated Vehicles (ROVs)

RDC Lead: Jay Carey, Surface Branch



VideoRay Pro-4 during Arctic Technology Demonstration 2013

The RDC is evaluating the capabilities and limitations of small ROVs. Last year, the RDC and MSST San Francisco deployed MSST Seattle's VideoRay Pro-4 to provide underwater imagery and support for a simulated oil spill recovery exercise. "From last year's exercise, ROVs proved to be a very useful diver replacement tool, but the technology did encounter some issues," said ROV RDC Lead Jay Carey. These included frequent high-humidity conditions in the pressure hull, tether pull due to ice floes, and loss of power, making it difficult to overcome high current conditions.

"From last year's exercise, ROVs proved to be a very useful diver replacement tool..."

Jayy Carey
ROV Project Lead

Since ROVs do have strong utility to facilitate Coast Guard operations in the Arctic, the RDC is conducting a comparative analysis between three Coast Guard owned and operated ROV models: the VideoRay Pro-4, Seabotix LBV200-4, and the Seabotix LBV300. Each model has its own unique characteristics which may help it perform better in the Arctic environment.

The VideoRay Pro 4, which is being provided by Regional Dive Locker San Diego, is completely computer driven by a sleek, intuitive, and powerful software platform. It has several features including vehicle autonomous control, sonar imaging, and positioning hardware and software. It weighs only 10 lbs and has over a 2 to 1 thrust to weight ratio, enabling it to operate in up to 4 knots of current and at depths of 1,000 feet. It operates the latest Wide Dynamic Range (WDR) color camera and LED lighting system to provide exceptional underwater imagery.

The Seabotix LBV200-4 is is equipped with four powerful brushless DC thrusters. It has a strong, small diameter, low drag umbilical and its systems are supplied with the latest WDR color camera technology and lighting. The ROV is 21" x 9.65" x 10" and weighs just 24.3 lbs and its maximum operating current is 2 kts and can operate in up to 660 feet of water.

The Seabotix LBV300 is larger than the Seabotix LBV200-4, with dimensions of 24.6" x 15.4" x 15.4" and a total weight of 40 lbs. It has an even smaller diameter tether and six brushless DC thrusters to propel it through the water. It operates the same state-of-the-art camera and lighting system but can operate in depths up to 1,000 feet.

A comparative analysis between these readily available ROVs will help the RDC understand which characteristics are desirable for the Arctic.

VideoRay Pro-4

For more info about VideoRay, visit http://www.videoray.com.

Seabotix LBV200-4

Seabotix LBV300

For more info about Seabotix, visit http://www.seabotix.com.

Oil In Ice Technology Demonstration 2013

The RDC successfully completed an Oil In Ice Technology Demonstration in September 2013 under D17's Arctic Shield exercise. The demonstration focused on a variety of technologies to support a simulated oil spill in and around ice floes. For this exercise, the RDC deployed for the first time on USCGC HEALY. The exercise involved the deployment of two UASs, one flown by NOAA and the other flown by the University of Alaska Fairbanks and Air Force Special Operations Command to detect, track, and monitor a simulated oil spill from the air. An AUV operated by the Woods Hole Oceanographic Institute was used to search for the simulated oil beneath the water and ice surface. Once detected, USCGC HEALY maneuvered into position to recover the simulated oil using a Vessel of Opportunity Brush Skimming System, owned an operated by Coast Guard Atlantic, Pacific, Gulf, and National Strike Teams. Additional underwater technologies including an ROV owned and operated by the Coast Guard Marine Safety and Security Teams Seattle and San Francisco, were utilized to monitor the progress of simulated oil recovery from beneath the waters surface. The imagery and trackline data was fed into NOAA's Environmental Response Management Application (ERMA) to provide situational awareness to decision makers. The knowledge gained and lessons learned during this demonstration were vital components to this year's technology evaluation planning.

Unmanned Aircraft Systems (UAS)

RDC Arctic UAS Lead: LT Keely Higbie, Surface Branch

The RDC is partnering with NOAA to deploy the Puma All Environment (AE) from CGC HEALY.

The Puma AE is a small UAS designed for land based and maritime operations. It is durable with a reinforced fuselage construction, man portable for ease of mobility and requires no auxiliary equipment for launch or recovery operations, making it suitable for operations in the Arctic region. The system is quiet to avoid detection and operates autonomously, providing persistent intelligence, surveillance, reconnaissance and targeting data (ISRT).

It carries both an electro-optical (EO) and infrared (IR) camera plus illuminator on a lightweight mechanical gimbaled payload, allowing the operator to keep "eyes on target." The precision navigation system with secondary GPS provides excellent positional accuracy and reliability. It's ground control station (GCS) has a communications range of 9 miles and allows the operator to control the aircraft manually or program it for GPS-based autonomous navigation.

For more info on the Puma AE, visit AV's website at http://www.avinc.com/

During last year's Arctic Shield exercise, the Puma AE delivered 2+ hours of flight endurance, despite the cold weather conditions.

NOAA launching PUMA AE during the Arctic Technology Demo in 2013

This summer, the RDC will utilize the Puma AE to demonstrate flight deck landings and to provide aerial oil tracking for the Oil In Ice project. To address lessons learned from last year's deployment, NOAA has developed flight deck landing procedures to help mitigate boat crew exposure risks and will conduct flight deck landings for the first time on a Coast Guard vessel. For the Oil In Ice project, a comparative analysis will be conducted between the oil tracking capabilities of the Puma AE vs. the aerostat.

The RDC & UAS

Article by RDC UAS Lead, Dr. Andrew Niccolai, Aviation Branch

The RDC has been investigating the utility of UAS for over 33 years, with the greatest concentration of efforts during the past several years. The most recent assessments include a series of Advanced Technology Demonstrations including: Insitu ScanEagle's off the National Security Cutter (NSC) (2012-2014), Aerovironment (AV) Puma's off the USCGC HEALY (2013-2014), and the Northrop Grumman Fire Scout off the NSC (2010-2014). The RDC has been the recipient of the NAVAIR PMA-263 Technology Transfer award of AV WASP III sUAS systems for capabilities demonstrations and sUAS CONOPS development. The RDC is also leading the efforts for evaluation of Group I UAS technologies for use on non-flight deck equipped cutters under the Robotic Aircraft from Maritime Public Safety (RAMPS) project. Future efforts include assisting with the development of a Business Case Analysis for the sUAS for NSC acquisition and expanding the role of UAS beyond intelligence gathering for Coast Guard applications within statutory missions.

Unmanned Surface Vessels (USVs)

RDC Lead: Brian Dolph, Surface Branch

USV's Utility

The USV can be outfitted with sensor packages to conduct long-term surveillance missions or be a real-time weather station with reporting capability.

The RDC is partnering with the Space and Naval Warfare Systems Command (SPAWAR) to deploy the Wave Glider SV2 USV from CGC HEALY.

The Wave Glider SV2 is the first unmanned autonomous marine robot to use only the ocean's endless supply of wave energy for propulsion. Its design enables cost-effective (up to 90 percent less) data collection and transmission for up to a year over a distance of thousands of miles. It is capable of carrying a broad array of sensor payloads and has significant onboard processing power.

The RDC will evaluate this technology's performance in the Arctic and its applicability/utility to enhance Coast Guard missions.

For more info about the Wave Glider SV, visit Liquid Robotics' website at http://liquidr.com.

Wave Glider SV2

RDC Arctic Technology Evaluation Team Members

Rich Hansen, Chief Scientist

Andres Aquino, Test Director

Jason Story, Arctic Craft Lead

LT Brent Fike, Arctic Craft Team

Liz Weaver, Arctic Comms Lead

Bill Jankowski, Arctic Comms Team

LT Mike Grochowski, Arctic Comms Team

LCDR Mike Turner, Arctic Nav Lead

Kurt Hansen, Oil In Ice Lead

Alex Balsley, Oil In Ice Team

Mike Coleman, Aerostat Lead

LT Keely Higbie, Arctic UAS Lead

Scot Tripp, AUV Lead

Brian Dolph, AUV Team

Jay Carey, ROV Lead

Have a research idea?

Submit it at:

https://cgportal2.uscg.mil/units/rdc/SitePages/upportRequest.aspx

The RDC In The Arctic

The Arctic has been a significant focus point of Coast Guard operations over the last several years. "The RDC plays a key role in charting the Service's future efforts in the Arctic by evaluating new and emerging technologies for the applicability to Coast Guard operations in the harsh and remote environment.," said RDC Commanding Officer, Capt. Dennis Evans.

The RDC first began research in the Arctic in the 1970's, assessing burning oil spilled on the ice. More recently, due to receding ice and increased vessel traffic and human activity, the RDC committed more of its project work to Arctic issues over the last eight years.

Since then, we have commissioned studies to improve RDC knowledge on Arctic issues, conducted oil in ice and Arctic craft testing n the Chukchi and Beaufort Seas, participated in multiple oil in ice response workshops and conferences, and have continuously conducted market research to identify the latest Arctic-capable technologies.

The Research, Development, Test & Evaluation Program (RDT&E)

At any given time, the Coast Guard's RDT&E program is working on more than 80 projects that support Coast Guard requirements across all mission areas. The RDT&E program is comprised of the Office of RDT&E at Coast Guard Headquarters in Washington, DC, and the Research & Development Center (RDC) at New London, CT. The RDC is the Coast Guard's sole facility performing applied RDT&E experimentation and demonstrations.

The RDT&E program enhances acquisition and mission execution by helping transition new technologies into the service's operational forces. The program also provides Coast Guard leadership with knowledge necessary for making strategic decisions. Test and evaluation activities support the entire Coast Guard in requirements verification planning, including mission-specific test preparation and deck-plate procedure execution.

The RDT&E program pursues technologies that provide incremental improvements as well as those with the greatest potential to strategically transform the way the Coast Guard does business. The program leverages partnerships with academia, other government agencies and private industry to anticipate and research solutions to future technological challenges.

The RDT&E program is dedicated to maintaining a balanced portfolio of projects that supports the Coast Guard's short, medium, and long range requirements across all mission areas. Projects fall under seven main program areas including Surface, Aviation, C4ISR, Acquisition Support & Analysis, Environment & Waterways, Modeling & Simulation Center of Excellence, and Test & Evaluation.